Framing and responding to scientific uncertainties

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Framing and Responding to Scientific Uncertainties: Biofuels and Synthetic Biology at the Convention on Biological Diversity

Scientific uncertainty is a persistent characteristic of many issues under international environmental governance, both in our understanding the current state of the environment and our ability to track the causes and magnitude of harms.[1] In international environmental law and policy, a key tool guiding decision-making in the face of scientific uncertainty is the precautionary principle/approach.[2] Since its initial debut in international environmental treaties in the mid-1980s, it has attracted controversy. A key point of dispute is whether it has achieved the status of a principle of customary international environmental law, and thus applies to all countries.[3] In the context of a treaty that includes a specific version of precaution, however, its legal character is not in question; Parties to the treaty have agreed to be bound. Even in such cases, precaution still draws attention and controversy, raising questions of what regulatory responses are justified or even required by it.[4]

This paper examines how precaution has been interpreted and applied in the context of the Convention on Biological Diversity's engagement with "New and Emerging Issues." The Convention text notes that: "where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat."[5] This "precautionary approach," as it is generally referred to within the CBD, is frequently invoked in the treaty's outputs. These invocations rarely explicitly declare what a stance of precaution entails. By tracing contending framings of scientific uncertainty in these debates, this paper argues that a narrow framing of scientific uncertainties influences how issues are understood and shapes the legal and policy tools for response.

This research is based on participant observation of CBD negotiating events from 2010 to 2014, "observant participation"[6] as an intern and a consultant with the CBD Secretariat in 2013 and 2014, document analysis, and semi-structured interviews with Secretariat staff, State delegates, and civil society observers. An ethnographic approach to policy and law-making processes can trace narratives and concepts as they are gradually institutionalized into

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[1] Rosie Cooney, *From Promise to Practicalities: The Precautionary Principle in Biodiversity Conservation and Sustainable Use*, *in* BIODIVERSITY AND THE PRECAUTIONARY PRINCIPLE, 3, 5 (Rosie Cooney & Barney Dickson, eds. 2005); Brian Wynne, *Uncertainty and Environmental Learning: Reconceiving Science and Policy in the Preventive Paradigm,* 2 GLOBAL ENVIRONMENTAL CHANGE 111, 114 (1992).

[2] The terms "principle" and "approach" do not have different legal weight, but politically are often used to indicate different interpretations of the meaning of precaution. Jacqueline Peel, *Precaution – A Matter of Principle, Approach, or Process?* 5 MELBOURNE JOURNAL OF INTERNATIONAL LAW 483 (2004).

[3] Countries can avoid obligations from a customary principle of international law by being a "persistent objector" during its development. For debate on the existence of a precautionary principle, see: Christopher D. Stone, *Is There a Precautionary Principle?,* 31 ELR NEWS & ANALYSIS 10790 (2001); Indur M. Goklany, THE PRECAUTIONARY PRINCIPLE: A CRITICAL APPRAISAL OF ENVIRONMENTAL RISK ASSESSMENT (2001); Peel, *supra* note 2.

[4] See: John S. Applegate, *The Taming of the Precautionary Principle,* 27 WILLIAM AND MARY ENVIRONMENTAL LAW AND POLICY REVIEW 13 (2002); Peel, *supra* note 2.

[5] Convention on Biological Diversity, 5 June 1992, preamble para. 9, U.N. Doc. UNEP/Bio.Div/N7-INC.S/4, *reprinted in* 31 I.L.M. 818 [hereinafter CBD].

[6] After David Mosse, as referenced in Maia Green, *Delivering Discourse,* 1 CRITICAL POLICY STUDIES 139, 141 (2007).

policies and programs that make up a field of governance.[7] This can be considered a process of co-production, by which orderings of nature and society (such as scientific knowledge and governing mechanisms) are produced together and often serve to reinforce each other.[8] The concept of co-production has particular salience at the international level, as globalization and new means of producing and assessing knowledge about a "global environment" have developed together.[9] Just as dominant ways of knowing are co-produced with systems to govern the known, dominant understanding of uncertainties are co-produced with systems to govern what is not known.

The CBD and New and Emerging Issues

The processes of decision-making examined here result in "Decisions" by the CBD's Conference of the Parties (COP). The CBD is widely recognized as a framework agreement in that it: 1) gives Parties considerable freedom to determine how to implement its provisions; and 2) explicitly allows the COP to negotiate legally binding protocols.[10] Outside of a protocol, however, outcomes of a CBD COP are not generally understood to bind Parties to *specific* actions. Rather, COP Decisions indicate agreement among the 194 CBD Parties on the boundaries of a given problem, desirable steps towards solutions, and principles to guide collaboration. They have the status of soft law – formal, but not legally binding.[11]

As the first step in developing a COP Decision, the CBD Secretariat drafts a set of "suggested Recommendations" for the Subsidiary Body on Scientific, Technical, and Technological Advice (SBSTTA). The SBSTTA, a technical advisory body to the explicitly political COP, agrees on "Recommendations" that serve as the basis for COP negotiations. These Recommendations are often heavily bracketed, indicating lack of consensus. At the COP, negotiations occur in large Working Group sessions, intended to include all Parties, and Contact Groups or Friends of the Chair, smaller meetings of interested Parties and observers. The CBD is notable for its openness[12]; other UN treaties often operate by closed meetings, either for only Party delegates or just a subset of Parties, but at the CBD formal sessions are almost always open.[13]

In 2006, the CBD COP introduced a new mechanism, "New and Emerging Issues" (NEI), to allow issues of particular novelty and urgency to be added to the SBSTTA's agenda.[14] This was not expected to trigger controversy; NEI was seen as formalizing a long-standing practice of introducing issues of relevance to the treaty system.[15] However, in 2007 SBSTTA 12

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[7] Catherine Corson, Shannon Hagerman & Noella J. Gray, *Capturing the Personal in Politics: Ethnographies of Global Environmental Governance,* 14 GLOBAL ENVIRONMENTAL POLITICS 21, 28 (2014).
[8] Sheila Jasanoff, *The Idiom of Co-production, in* STATES OF KNOWLEDGE: THE CO-PRODUCTION OF SCIENCE AND SOCIAL ORDER 1, 2 (Sheila Jasanoff ed., 2004).
[9] Christophe Bonneuil & Lew Levidow, *How Does the World Trade Organization Know? The Mobilization and Staging of Scientific Expertise in the GMO Trade Dispute*, 42 SOCIAL STUDIES OF SCIENCE 75, 76 (2011).
[10] Secretariat interviews 2013; LYLE GLOWKA, ET AL. A GUIDE TO THE CONVENTION ON BIOLOGICAL DIVERSITY (IUCN, 1994).
[11] For more on soft law, see: Pierre-Marie Dupuy, *Soft Law and the International Law of the Environment, in* INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 349 (David Hunter, James Salzman & Durwood Zaelke eds, 2nd ed, 2002).
[12] Elisa Morgera & Elsa Tsioumani. *Yesterday, Today, and Tomorrow: Looking Afresh at the Convention on Biological Diversity.* 21 YEARBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 3, fn. 113 (2010).
[13] Chairs generally restrict the vocal engagement of observers and non-Parties, but they are allowed in the room, and sometimes are granted the opportunity to speak.
[14] See Decision VIII/10 Annex A(d), 'Operations of the Convention' (15 June 2006), found in 'Eighth Meeting of the Parties to the Convention on Biological Diversity' (UNEP/CBD/COP/8/31, 15 June 2006).
[15] CBD Secretariat interviews 2013.

identified biofuels as the first NEI after contentious discussions.[16] This began years of negotiations marked by disagreement and often acrimony, as CBD Parties debated how the treaty should respond. Although almost all of the possible options for response would be legally soft, bodies such as the EU could incorporate CBD guidelines into formal certification processes, thus 'hardening' them.

Much of the debate has revolved around the uncertain impacts of biofuel production and use. For example, as discussed below, the role of indirect land-use change (ILUC) has been debated. ILUC describes displacement effects; biofuel production could cause ILUC if a land use such as pastoralism was displaced for biofuel feedstock, and other land was converted to replace the lost pastoral lands.[17] Taking such indirect impacts into account can significantly impact the total carbon and GHG emissions and other impacts on biodiversity attributed to any given biofuel project. Calculating ILUC is "extremely difficult and fraught with uncertainty."[18] The impacts and extent of ILUC cannot be directly observed, and thus scientists and policy-makers are reliant on models, which display a broad range of results because of differences in starting assumptions, model design, and resolution.[19]

Narratives of 'next generation' biofuels promise to avoid the social, ecological and economic challenges of conventional biofuels, by providing technologies that will produce fuel from waste and create feedstocks that grow quickly and affordably on marginal lands.[20] Synthetic biology has been broadly considered a key approach to developing viable next generation biofuels,[21] and was introduced to the CBD biofuels discussions in 2010 at SBSTTA 16. Synthetic biology is commonly described as 1) the design and construction of new biological parts, devices, and systems, and 2) the re-design of existing, natural biological systems for useful purposes.[22] Critical civil society groups describe synthetic biology as "extreme genetic engineering," because genetic design and synthesis technologies make possible the production of more novel organisms.[23] While some argue that the greater precision of synthetic biology tools decrease uncertainties regarding ecological, human health and other impacts,[24] others argue that synthetic biology opens up new areas of uncertainty.[25] As a group of policy analysis and ecologists have pointed out: "No one yet understand the risks that synthetic

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[16] Xenya Cherny Scanlon et al. *Summary of the twelfth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice and second meeting of the* Ah Hoc *Open-Ended Working Group on Review of Implementation of the Convention on Biological Diversity: 2-13 July 2007,* 9 EARTH NEGOTIATIONS BULLETIN 7 (2007).

[17] T. Searchinger et al., *Use of US Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change,* 319 SCIENCE 1238, 1238 (2008); Lorenzo Di Lucia et al., *The Dilemma of Indirect Land-Use Changes in EU Biofuel Policy,* 16 ENVIRONMENTAL SCIENCE & POLICY 9, 9 (2012).

[18] NUFFIELD COUNCIL ON BIOETHICS, BIOFUELS: ETHICAL ISSUES, xxi (2001).

[19] Di Lucia et al, *supra* note 17.

[20] Simonetta Zarrilli. *Development of the emerging biofuels market, in* GLOBAL ENERGY GOVERNANCE: THE NEW RULES OF THE GAME, 73, 93 (Andreas Goldthau & Jan Martin Witte eds, 2010).

[21] Adrian Mackenzie, *Synthetic Biology and the Technicity of Biofuels*, 44 STUDIES IN HISTORY AND PHILOSOPHY OF BIOLOGICAL AND BIOMEDICAL SCIENCES 190, 190 (2013).

[22] This definition comes from a website initiated by synthetic biologists at MIT and Harvard: http://syntheticbiology.org/, accessed on 22 September 2015. Discussion on the lack of a common definition can be found in: Various, *What's in a Name?* 27 NATURE BIOTECHNOLOGY 1071 (2009).

[23] FRIENDS OF THE EARTH ET AL., THE PRINCIPLES FOR THE OVERSIGHT OF SYNTHETIC BIOLOGY 2 (2012).

[24] See, for example: Victor de Lorenzo, *Environmental Biosafety in the Age of Synthetic Biology: Do We Really Need a Radical New Approach?* 32 BIOESSAYS 926 (2010).

[25] See, for example: Allison A. Snow & Val H. Smith. *Genetically Engineered Algae for Biofuels: A Key Role for Ecologists*, 62 BIOSCIENCE 765 (2012).

organisms pose to the environment, what kinds of information are needed to support rigorous assessments, or who should collect such data."[26]

Since 2010, CBD COP Decisions on biofuels have addressed synthetic biology.[27] At the same time, the issue has been under on-going consideration as a stand-alone NEI. Since biofuels were named the first NEI, the CBD COP has elaborated a formal process for identifying NEI, with seven criteria, including: relevance of the issues to the Convention's objectives; new evidence of unexpected and significant impacts on biodiversity; and urgency.[28] Since the NEI criteria were developed, no substantive issue has been added to the CBD's agenda through this mechanism.[29]

The next sections describe three instances of the treaty bodies' engagement with various kinds of uncertainties related to biofuels and synthetic biology.

Biofuels at COP 10: Narrowing the Range of Uncertainties

The COP 10 biofuel negotiations were based on the SBSTTA 14 Recommendations, which included numerous bracketed references to scientific uncertainty and the need for precaution.[30] These Recommendations prompted debate on the status of scientific knowledge and contending framings of scientific uncertainties relating to biofuels. Below, I map actors' descriptions onto four categories of scientific uncertainty and examine how these different framings corresponded with expressions of the relevance and meaning of precaution.

The term "scientific uncertainty" encompasses a broad range of ways and qualities of not knowing. When categorized by characteristics that impact decision-making, relevant categories include: risk, uncertainty, ambiguity, and ignorance. *Risk* refers to situations in which potential outcomes can be identified and their probabilities attributed.[31] *Uncertainty* describes a situation in which the types and scales of possible harms are understood, but their probabilities are not.[32] *Ambiguity* refers to situations in which, rather than the probability of harm being in question, the meaning of the harm is unclear or contested.[33] In situations of

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[26] Genya V. Dana et al., *Four Steps to Avoid a Synthetic-Biology Disaster*, 483 NATURE 29, 29 (2012).

[27] See Decision X/37 'Biofuels and Biodiversity' (20 January 2011), found in 'Report of the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity' (UNEP/CBD/COP/10/27*, 20 January 2011), Annex; Decision XI/27 'Biofuels and Biodiversity' (5 December 2012), found in 'Report of the Eleventh Meeting of the Conference of the Parties to the Convention on Biological Diversity' (UNEP/CBD/COP/11/35, 5 December 2012), Annex I.

[28] Decision IX/29 para. 12 'Operations of the Convention' (9 October 2008), found in 'Report of the Ninth Meeting of the Conference of the Parties to the Convention on Biological Diversity' (UNEP/CBD/COP/9/29*, 9 October 2008), Annex I.

[29] Tropospheric ozone was unceremoniously added as an NEI in 2012, but the NEI criteria were not explicitly applied, and the treaty bodies have given it minimal attention. CBD Secretariat interview 2012.

[30] SBSTTA Recommendation XIV/10 'Agricultural Biodiversity' part B (30 June 2010), found in 'Report of the Fourteenth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice' (UNEP/CBD/COP/10/3, 30 June 2010), Annex.

[31] Wynne, *supra* note 1; Andy Stirling, *Risk, Precaution and Science: Towards a More Constructive Policy Debate*, 8 EMBO REPORTS, 309, 310 (2007).

[32] This paper uses "scientific uncertainty" as the broadest category encompassing these different types, and "uncertainty" as one specific type. ULRIKE FELT ET AL. TAKING EUROPEAN KNOWLEDGE SOCIETY SERIOUSLY: REPORT OF THE EXPERT GROUP ON SCIENCE AND GOVERNANCE TO THE SCIENCE, ECONOMIC AND SOCIETY DIRECTORATE, DIRECTORATE-GENERAL FOR RESEARCH, EUROPEAN COMMISSION, 36 (2007); Stirling, *supra* note 31, at 310.

[33] Andy Stirling, *Science, Precaution, and the Politics of Technological Risk: Converging Implications in Evolutionary and Social Scientific Perspectives,* 1128 ANNALS OF NEW YORK ACADEMY OF SCIENCES 95 (2008); Stirling, *supra* note 31, at 310.

ignorance, not all of the possible impacts can be predicted or even understood; we don't know what it is we don't know.[34]

Risk

Numerous delegations to COP 10 framed biofuels as well understood - ie, as "risks," with identifiable potential outcomes for which probabilities could be attributed. On the first day of formal negotiations on biofuels, several South American delegations called for the deletion of reference to scientific uncertainty,[35] because it did not reflect the "reality" of scientific knowledge[36] or the "complexity" of the issue.[37] To support their assertion that biofuels presented no unknowns, the Brazilian delegation argued throughout the negotiations for a narrow scope to the biofuels Decision. Brazil tried to remove: mentions of direct and indirect impacts on land and water use because that is broader than biodiversity[38]; biosafety concerns because they are not unique to biofuels[39]; and mention of synthetic biology because it is used more broadly than for biofuels.[40] By narrowing the issues of concern, areas of uncertainty would be restricted to the better understood aspects of biofuel production, leaving only manageable risks.

The strongest advocates for a "risk" framing of biofuels also argued that precaution should not be invoked at all. Brazil and Argentina delegations consistently pushed to rid the Decision of any mention of the precautionary approach.[41] As a businessman on the Brazilian delegation explained at a side event, the impacts of producing sugar in Brazil are "very clear…we don't need to adopt the precautionary approach or principle to produce sugarcane."[42]

While these delegations argued that understood risks do not require precaution, the EU delegation *only* invoked the need for precaution in the biofuel negotiations where scientific evidence of harm existed (ie, risks). The EU delegation insisted that biofuels be mentioned in relation to invasive alien species, and that the precautionary approach be invoked, because there is scientific evidence that biofuel crops have become invasive.[43] On the other hand, the EU delegation argued against including synthetic biology in the biofuels Decision because there was "not sufficient scientific evidence" to justify its inclusion.[44]

Uncertainty

Some delegations framed biofuels as presenting known challenges – they would list off areas of impacts – but lacking sufficient scientific evidence to allow for prediction and full understanding. For example, Tunisia described information on biofuels' impacts on biodiversity and socio-economic conditions as "quite pathetic," and requiring a scientific

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[34] Wynne, *supra* note 1, at 114; Stirling *supra* note 31, at 310.
[35] COP 10, Working Group I, 21 October 2010: Brazil, Paraguay & Argentina.
[36] COP 10, Working Group I, 21 October 2010: Brazi.
[37] COP 10, Working Group I, 21 October 2010: Argentina.
[38] COP 10, Biofuels Contact Group, 25 October 2010.
[39] COP 10, Biofuels Contact Group, 26 October 2010.
[40] COP 10, Working Group I, 21 October 2010; COP 10, Biofuels Contact Group, 26 October 2010; COP 10, Biofuels Friends of the Chair, 27 October 2010.
[41] This occurred at: COP 10 Working Group 1, 21 October 2010; COP 10, Biofuels Contact Group, 21 & 26 October 2010; COP 10, Biofuels Friends of the Chair, 27 October 2010.
[42] COP 10, side event ETC Group, 18 October 2010.
[43] The Biofuel Contact Group was tasked with developing a paragraph on biofuels for the Invasive Alien Species Decision. COP 10, Biofuels Contact Group, 21 October 2010.
[44] COP 10, Working Group I, 21 October 2010.

evaluation.[45] Similarly, Algeria warned that the stakes were high – biofuels could destroy basic systems of production – but they lacked "enough data to respond to these issues."[46]

Uncertainty was essentially expressed as gaps in knowledge on impacts. Precaution was then framed as a necessary stop-gap, urging a pause in production until the situation was better understood. Algeria phrased it as an "ounce of cure" instead of an infection after.[47]

Ambiguity

Few interventions at COP 10 dwelt on the contested *meaning* of harms posed by biofuels. A representative from UNEP and UN Energy came close, noting that biodiversity impacts were difficult to address with the "typical kind of indicators," and thus the precautionary principle was "critical."[48] Indeed, as discussed later, methods for measuring or modelling impacts of biofuels on biodiversity, particularly at a large scale, are highly contentious. This representative seemed to imply that, because biodiversity impacts could not be reliably measured, precaution should be applied. She did not describe what this application should look like, but tying it to the unique challenges of measuring biodiversity impacts, she seemed to be calling for essentially an institutionalization of precaution.

Ignorance

Party delegations stressing the unknown aspects of synthetic biology, such as the Africa Group, the Philippines and Bolivia, argued for a moratorium on the environmental release of organisms produced using synthetic biology. The Philippines delegation often portrayed the state of knowledge of synthetic biology as ignorance, noting that there was no "scientific certainty" on the impacts, and that a moratorium could be lifted once there was "scientific certainty."[49] The Philippines thus called for acting with precaution until synthetic biology's impacts were known to be safe. Flipping the burden of proof – demanding proof of safety rather than evidence of specific danger – is one interpretation of the precautionary approach.[50]

Civil society groups intervened throughout the biofuel negotiations to claim a lack of understanding of the impacts of biofuels and, especially, of organisms produced using synthetic biology.[51] As a representative of the Federation of German Scientists argued in a session of the Contact Group, "we do not know how to assess" the organisms modified to enable biofuel processing.[52] These groups did not call for more research to quantify known impacts; they claimed a state of ignorance in how to identify and assess impacts. Their comments verged on describing the impacts of synthetic biology as not just unknown but unknowable.

Outcomes of Uncertainty at COP 10

As expressed by actors over the course of COP 10, biodiversity-related aspects of biofuels involve a range of kinds of uncertainties. Decision X/37 does not reflect this range. Rather than "acknowledging scientific uncertainty," the preambular paragraph recognizes "gaps in

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[45] *Ibid.*
[46] *Ibid.*
[47] *Ibid.*
[48] *Ibid.*
[49] COP 10, Biofuels Contact Group, 26 October 2010.
[50] Peel, *supra* note 2, 486.
[51] For example, at: COP 10 Working Group I, 21 October 2010; COP 10, Biofuels Contact Group, 26 & 27 October 2010.
[52] COP 10, Biofuels Contact Group, 26 October 2010.

scientific knowledge and concerns that exist regarding such impacts."[53] The one explicit call to apply the precautionary approach is "to the introduction and use of living modified organisms for the production of biofuels as well as to the field release of synthetic life, cell, or genome into the environment, acknowledging the entitlement of Parties, in accordance with domestic legislation, to suspend the release of synthetic life, cell, or genome into the environment."[54]

Describing scientific uncertainties as "gaps in knowledge" frames biofuels as *knowable*, even if not currently known – essentially acknowledging risks and uncertainties, but not the more complex situations of ambiguity and ignorance. It ignores broader difficulties and concerns with identifying and measuring the impacts of biofuels on biodiversity and related socioeconomic impacts. The precautionary approach is restricted to synthetic biology and living modified organisms[55] - the uncertainties they pose are not described, and neither is what "precaution" means for biofuel production and use. Suspending environmental release is one possible application of precaution, but the Decision's language painfully avoids recommending such action – if Parties have national legislation for this, well then, they are entitled to do that. It is a thin application of precaution to a narrow slice of the controversies and uncertainties posed by biofuels.

If biofuels pose only "gaps" in knowledge, what happens to aspects that fall outside of scientific measurement, monitoring, and ways of knowing? What happens over time if the precautionary approach is invoked without engaging its substantive meaning? Subsequent to COP 10, the CBD has come up against both of these challenges in its engagement with biofuels and synthetic biology.

Biofuels after COP 10: Responding to the challenge of indirect land-use change.
Before COP 11, the CBD Secretariat published a technical series paper, *Biofuels and Biodiversity,* which described ILUC as causing known harms but challenging quantification of these harms in terms of "scale and severity."[56] The inability to accurately quantify ILUC impacts is not framed as a temporary challenge, but rather the result of fundamental differences in methodologies and key assumptions.[57] Thus, the Secretariat can be seen as describing ILUC as an intractable uncertainty, for which the type of harm is understood, but the scale and probability are fundamentally unknowable.

For the 16th meeting of SBSTTA, the CBD Secretariat prepared suggested text requesting SBSTTA to assess the effectiveness of tools and approaches for strategic environmental assessment of biofuels and integrated land-use planning. This would have required grappling

[53] Decision X/37, *supra* note 27, preamb. para. 2.
[54] *Ibid*, para. 16. The Decision on Invasive Alien Species also includes a paragraph calling for the application of the precautionary approach in using invasives as feedstock for biofuels. Decision X/38 'Invasive Alien Species' para. 6 (20 January 2011), found in 'Report of the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity' (UNEP/CBD/COP/10/27*, 20 January 2011), Annex.
[55] "Living modified organisms" is a term of art specific to the CBD that is generally understood to align with the more common term "genetically modified organisms." The Decision also invites Parties to "tak(e) into account paragraph 3 of Decision IX/2," which includes the precautionary approach among a list of eleven relevant tools and guidance. *Ibid*, para. 8. Legally, therefore, Parties are invited to take precaution into account in interpreting the entire Decision X/37, but politically such an oblique mention is understood to downplay this. Throughout the NEI negotiations delegations have fiercely debated whether to use specific language or merely cite past Decisions using that language.
[56] ANNIE WEBB & DAVID COATES. BIOFUELS AND BIODIVERSITY, 7 & 38. Secretariat of the Convention on Biological Diversity, Technical Series No. 65. (2012).
[57] *Ibid,* at 43.

with the uncertainties inherent in these tools. Instead, the 'action point' in the 2012 COP 11 Decision requests the Secretariat to "compile information on relevant definitions of relevant key terms."[58]

In response, the CBD Secretariat's 2014 report on definitions included a section on "direct and indirect land use change."[59] Monitoring and managing ILUC is described as "difficult and complex," and ILUC is a "key issue regarding the sustainability of biofuels production and use with regard to biodiversity."[60] The Secretariat explains that, because of ILUC, biofuel production can not be defined as "sustainable" based on site-specific factors, and that models are necessarily required.[61]

At SBSTTA 18, some delegations strenuously argued that the report and its reflections on ILUC were "unbalanced" and "incomplete."[62] A Brazilian delegate said that the report's discussion on ILUC failed to acknowledge that models "lack accurate methodology" for "precise results," and that therefore assessments of ILUC were not only uncertain but also "unobservable, unverifiable, and reliant on assumed economic and social contexts in the modelling."[63] An Argentinian delegate noted that there was no "international consensus" on ILUC because of the "difficulty in quantifying" it.[64] SBSTTA 18 ultimately requested the Secretariat to revise the document and submit it to further peer-review.[65]

ILUC presents a threat that, as Brazil said, is "not something verified nor verifiable."[66] There is no clear timeline or path by which the attendant uncertainties in measuring or managing ILUC will be resolved. The message from Brazil and Argentina was that the difficulties in quantifying ILUC meant that data on the phenomenon was an unreliable and thus unjustifiable basis for environmental policy.

Social scientists have noted that decision-makers often overstate the degree to which scientific uncertainties can be reduced and resolved.[67] This arguably happened at COP 10, as a broad range of uncertainties were described as "gaps in knowledge." In the case of indirect land use change, however, its complexity was not reframed as something simpler. Instead, Parties essentially argued that the issue could be not addressed because it was indeterminate – ie, context specific, embedded in co-evolving "social, technological, and natural systems."[68]

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[58] Decision XI/27, *supra* note 27, para. 10.
[59] CBD Executive Secretary, *Biofuels and Biodiversity: Information on Relevant Definitions of Relevant Key Terms to Enable Parties to Implement Decisions IX/2 and X/37.* (UNEP/CBD/SBSTTA/18/15, 26 April 2014).
[60] *Ibid*, 4.
[61] *Ibid.*
[62] SBSTTA 18, Plenary, 26 June 2014, Brazil & Argentina.
[63] *Ibid*, Brazil.
[64] *Ibid,* Argentina.
[65] Recommendation XVIII/12 'Biofuels and Biodiversity: Information on Relevant Definitions of Relevant Key Terms to Enable Parties to Implement Decisions IX/2 and X/37' (28 June 2014), found in 'Report of the Eighteenth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice' (UNEP/CBD/COP/12/3, 28 June 2014), Annex.
[66] SBSTTA 18, Plenary, 26 June 2014.
[67] Steve Hinchliffe, *Indeterminacy In-Decisions – Science, Policy and Politics in the BSE (Bovine Spongiform Encephalopathy) Crisis,* 26 TRANSACTIONS OF THE INSTITUTE OF BRITISH GEOGRAPHERS 182, 183 (2001); NUFFIELD COUNCIL ON BIOETHICS, EMERGING BIOTECHNOLOGIES: TECHNOLOGY, CHOICE AND THE PUBLIC GOOD, 51 (2012).
[68] Felt et al., *supra* note 32, at 36.

Brazil and Argentina framed such indeterminate uncertainties as illegible to the CBD,[69] and thus not requiring a response from the treaty bodies.

Synthetic biology after COP 10: applying NEI criteria in the absence of evidence.
Since the 2010 COP 10, CBD bodies have been actively considering whether to add synthetic biology as an NEI to the agenda of the CBD, but have not yet made a decision. When Parties submitted only a handful of documents, the next COP allowed the Secretariat to take a more active role. Decision XI/11 requested the Secretariat to "compile and synthesize relevant available information" of synthetic biology and its potential impacts on the conservation and sustainable use of biodiversity and associated social, economic and cultural considerations, and to analyse how the NEI criteria applied.[70] Thus, synthetic biology became the first issue to which the Secretariat was asked to explicitly apply the NEI criteria.[71]

As the consultant responsible for drafting this document, I encountered several layers of ambiguity. It was an open question whether *each* criterion needed to be met in order to qualify as an NEI. At the 2012 negotiations, delegations seemed to generally share the assumption that synthetic biology would not meet criterion (b): "new evidence of significant impacts on biodiversity," but disagreed on what this meant. Some delegations insisted this meant that synthetic biology did not meet the standard of an NEI,[72] while others countered that Decision IX/29 could be interpreted as not requiring each criterion, or even that Parties had the political power to change the criteria.[73] The COP 11 Decision provided no guidance on this, simply requesting the Secretariat to "apply" the criteria.

Furthermore, applying the criteria was not a straightforward task. The simple answer to criterion (b) is that there is *not* new evidence of significant impacts of synthetic biology on biodiversity.[74] Most research was not at the stage of commercialization, and the impacts of products that had been commercialized were not systematically tracked. But what meaning should be attributed to this lack of evidence? Did it highlight the lack of research investigating ecological impacts of organisms and products of synthetic biology, or associated socio-economic impacts? Did it raise questions of the timing of the CBD's engagement with emerging issues? Or did it simply mean that, for the purposes of the CBD, synthetic biology was of no concern?

The Secretariat document applying the criteria did not attempt to answer these questions, or the overall question of whether the criteria had been "met." Rather, it pointed to how the compiled evidence spoke to the criteria and some of the ways this could be interpreted.[75] At the June 2014 SBSTTA 18 meeting, delegations repeatedly clashed over different

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[69] The concept of State legibility and thus governability comes from JAMES SCOTT, SEEING LIKE A STATE (1998).
[70] Decision XI/11, 'New and Emerging Issues Relating to the Conservation and Sustainable Use of Biodiversity' para. 3 (5 December 2012), found in 'Report of the Eleventh Meeting of the Conference of the Parties to the Convention on Biological Diversity' (UNEP/CBD/COP/11/35, 5 December 2012) Annex I.
[71] As of October 2015, this is still the only instance of explicit application of the NEI criteria.
[72] COP 11, NEI Friends of the Chair, 15 October 2012, EU, Canada & New Zealand.
[73] *Ibid,* Philippines & Ghana for the Africa Group.
[74] *See* DEBORAH SCOTT ET AL. POTENTIAL POSITIVE AND NEGATIVE IMPACTS OF COMPONENTS, ORGANISMS AND PRODUCTS RESULTING FROM SYNTHETIC BIOLOGY TECHNIQUES ON THE CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY, AND ASSOCIATED SOCIAL, ECONOMIC AND CULTURAL CONSIDERATIONS. PART I OF: SYNTHETIC BIOLOGY. Secretariat of the Convention on Biological Diversity, Technical Series No. 82 (2015).
[75] CBD Executive Secretary, *New and Emerging Issues: Synthetic Biology.* (UNEP/CBD/SBSTTA/18/10, 25 April 2014).

interpretations of the criteria and their application. The Brazilian delegation described knowledge on synthetic biology as "incipient" and "not mature enough" to be taken up as an NEI.[76] Canada did not believe the "state of knowledge is sufficient" to determine whether synthetic biology was an NEI.[77] Delegations such as the EU, Austria, and Bolivia countered that the Secretariat's analysis showed that the criteria were met.[78] Some delegations simply stated that synthetic biology was an NEI, without referencing the criteria.[79]

The SBSTTA 18 Recommendation on NEI concluded that there was "currently insufficient information available to finalize an analysis, using the criteria set out in paragraph 12 of Decision IX/29, to decide whether or not this is a new and emerging issue," and "*awaits* the completion of a robust analysis."[80] The Mexican delegate voiced the apparently shared expectation that the results of this future analysis would "say whether (synthetic biology) is emerging or not!"[81]

There was consensus at SBSTTA 18 that the COP should urge Parties to "take a precautionary approach," but no agreement on what this entailed.[82] The CBD's engagement with synthetic biology overall displays treatment of the precautionary approach as a 'boundary object.' Boundary objects are concepts "plastic enough to adapt to local needs…yet robust enough to maintain a common identity."[83] While this flexibility allows delegates to agree on text despite a lack of consensus, it can also facilitate avoidance of differences, deferring conflict.[84] In this case, when Parties were confronted with a lack of scientific evidence - a situation that might call for actually *applying* precaution and not merely *invoking* it – Parties chose to delay decision-making in the hope that a technical process, rather than a political one, would provide answers.

Moving Forward: Scientific Uncertainties at the CBD

Disagreements among CBD Parties on biofuels and synthetic biology are based on more than different approaches to scientific uncertainties; these issues raise geopolitical tensions, different approaches to development, and even military considerations.[85] However, in the context of the CBD, these disagreements have been primarily expressed as disputes over science, certainty, and responses to a lack of certainty. While the CBD's engagement has not resulted in concrete guidelines for biofuel production or synthetic biology research or application, it has been productive nonetheless – most notably, it has produced a particular version of the precautionary approach that responds to a narrow range of scientific uncertainties and acts as a placeholder in lieu of political agreement.

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[76] SBSTTA 18, Plenary, 24 June 2014.
[77] *Ibid.*
[78] SBSTTA 18, Plenary, 24 June 2014, EU & Austria; SBSTTA 18, NEI Contact Group, 26 June 2014, Bolivia.
[79] SBSTTA 18, Plenary, 24 June 2014, Egypt, Costa Rica, & Zambia for the Africa Group.
[80] Recommendation XVIII 'Synthetic Biology' para. 1 & 2 (28 June 2014), found in 'Report of the Eighteenth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice' (UNEP/CBD/COP/12/3, 28 June 2014), Annex.
[81] SBSTTA 18, NEI Contact Group, 26 June 2014.
[82] Recommendation XVIII, *supra* note 80, para. 3.
[83] Susan Leigh Star & James Griesemer, *Institutional Ecology, "Translations," and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Verterbrate Zoology, 1907-39*, 19 SOCIAL STUDIES OF SCIENCE 387, 393 (1989).
[84] Noella J. Gray et al. *Boundary Objects and Global Consensus: Scalar Narratives of Marine Conservation in the Convention on Biological Diversity,* 14 GLOBAL ENVIRONMENTAL POLITICS 64, 79 (2014).
[85] See: Nuffield, *supra* note 18; Dana et al., *supra* note 26.

Others have written extensively on what "precaution" could mean, suggesting that assessment include questions such as: who benefits from the proposed action and who stands to bear the costs; what degree of control potentially affected communities have; what indirect effects may exist; what are divergent scientific perspectives; and what alternatives exist.[86] With its 'soft' stakes and comparatively broad participation, the CBD has the institutional background and legal flexibility to experiment with such strategies for decision-making in the face of scientific uncertainties. Rather than being added to the treaty's agenda, the designation of "New and Emerging Issues" could delineate issues requiring further research, deliberation, and exploration – i.e., issues triggering a precautionary stance. This would be a matter of shifting interpretation, not re-negotiation.

This could not only re-introduce the New and Emerging Issues mechanism as an active tool; it could also establish the CBD as a major international treaty that acknowledges indeterminacies and stubborn uncertainties. Emerging technosciences increasingly challenge our predictive abilities; the complexities of the global environment seemingly multiply the more knowledge we gain. The CBD could chart the path forward for environmental governance in this "post-predictive paradigm."[87] But this will require acknowledging a broader range of scientific uncertainties, and using a precautionary approach to guide its actions where this is a "lack of full scientific certainty."

[86] Nuffield, *supra* note 67, at 71; Stirling, *supra* note 31, at 313; Peel, *supra* note 2, at 497.
[87] Phil Macnaghten, Matthew B. Kearnes, & Brian Wynne, *Nanotechnology, Governance, and Public Deliberation: What Role for the Social Sciences?* 27 SCIENCE COMMUNICATION 268, 285 (2005).